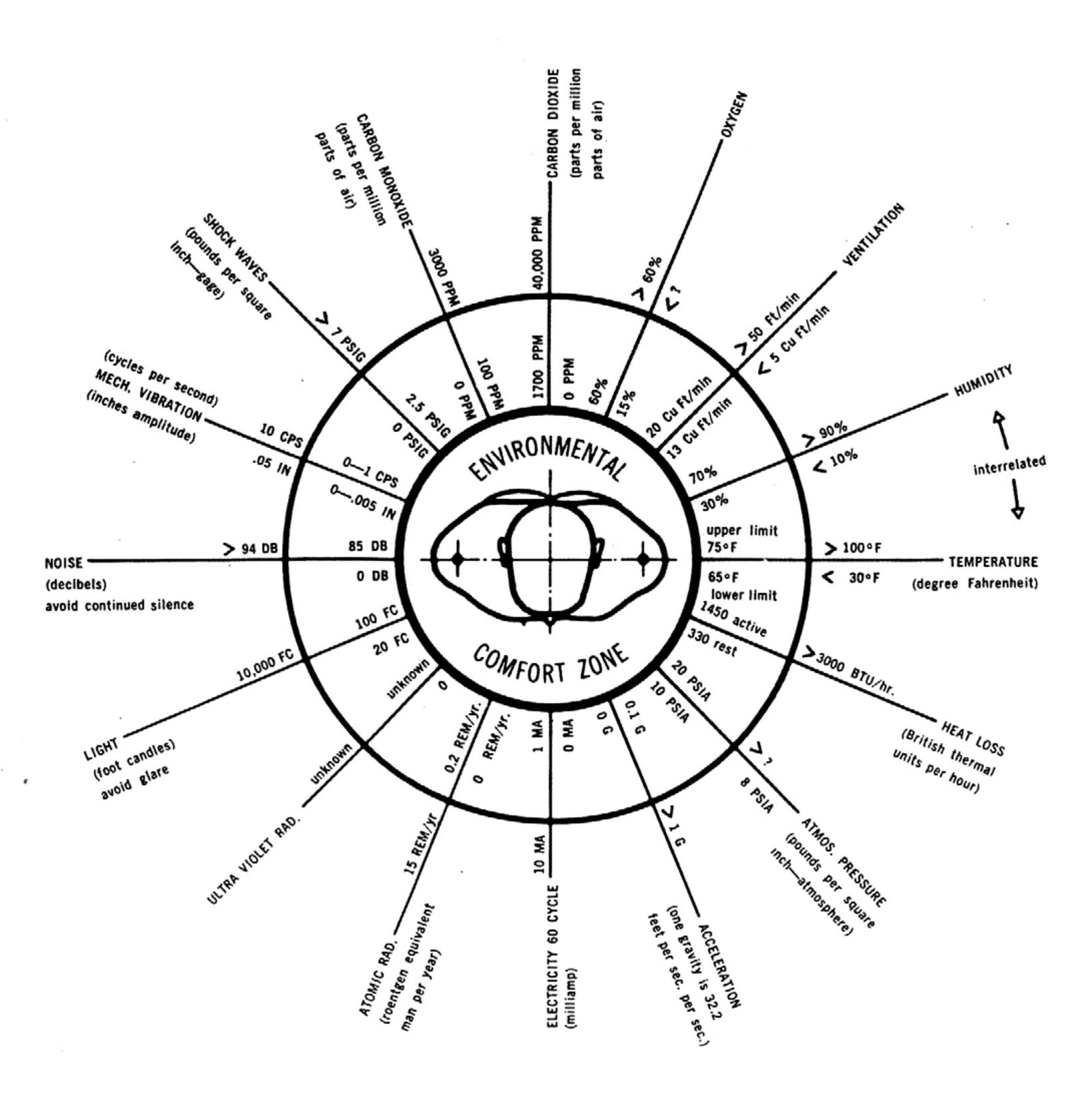
THE MEASURE OF MAN
HUMAN FACTORS IN DESIGN
HENRY DREYFUSS



The first circle is the bearable zone limit. Outside this limit great discomfort or possible damage is encountered. It is also necessary to consider: infra-red radiation, ultra sonic vibration, noxious gases, dust, pollen, and heat exchange with liquids and solids.

Note: All data here are subject to qualification, refer to reference sources; for complete information see bibliography.



ANTHROPOMETRIC DATA — STANDING ADULT MALE

ACCOMMODATING 95% OF U.S. ADULT MALE POPULATION

2.5%tile	50.%tile	97.5%tile
weight — 127.7 LB.	weight — 161.9 LB.	weight — 208.9 LB.
span — 65.5"	span — 70.8"	span — 76.6"
akimbo — 34.9"	akimbo — 38.4"	akimbo — 42.4"

0" datum

4.2 shoe

5.25 arctic shoe

76.5 total

A.F. heavy winter clothing

dynamic link system shown



ANTHROPOMETRIC DATA — STANDING ADULT MALE

ACCOMMODATING 95% OF U.S. ADULT MALE POPULATION

2.5 %tile	50. %tile	97.5 %tile
chest circ. — 34.4"	chest circ. — 38.7"	chest circ. — 43.9"
waist circ. — 27.1"	waist circ. — 31.7"	waist circ. — 38.8"
hip circ. — 33.7"	hip circ. — 37.7"	hip circ. — 42.6"

2.5 %tile: 64.4, 60.1, 8.0, 52.1, 50.3, 35.6, 33.9, 29.8, 28.4, 18.2, 3.0, 0" datum, 9.6, 26.5, 10.3, 9.4, 6.8, C.G.

50. %tile: 50° max. 30° easy, 50° max. 30° easy, opt. head movement none., 69.1, 64.7, 8.7, 56.6, 54.6, 38.2, 36.6, 32.8, 31.6, 19.8, 3.5, 1.0, shoe 11.7, 10.5, 28.5, 11.1, 9.9, 7.5, 4" bent, comfort range, 2-3°, rest, 21°, 33°, C.G.

97.5 %tile: 76.5 total ht., 74.0, 69.4, 9.8, 61.1, 59.0, lung cap.: 30 cu. in., 9.9 12.0 max., 40.9, 39.3, 36.3, 34.9, 21.3, A.F. heavy winter clothing, 2 to 3°, normal ℄ of legs standing, varies, 30° stand 15° walk or run, 3.8, 1.25, 11.4, 14.3 arctic shoe, 30.7, 12.0, 10.5, 8.2, C.G.



ANTHROPOMETRIC DATA — STANDING ADULT FEMALE

ACCOMMODATING 95% OF U.S. ADULT FEMALE POPULATION

2.5 %tile	50. %tile	97.5 %tile
weight — 95.0 LB.	weight — 134.8 LB.	weight — 195.0 LB.
span — 58.8"	span — 64.7"	span — 70.2"
akimbo — 31.8"	akimbo — 34.7"	akimbo — 38.0"

dynamic link system

0" datum



ANTHROPOMETRIC DATA — STANDING ADULT FEMALE

ACCOMMODATING 95% OF U.S. ADULT FEMALE POPULATION

2.5 %tile

50. %tile

97.5 %tile

easy head movement
50° max.
30°
30°
50° max.
7.1
63.2"
1.3
3.9
59.3
2.3
7.8
2.0
164°
179°
191°
51.7
49.8
10.2
40°
55°
71°
26.2
9.1
33.1
2.4
63°
98°
119°
2.9
15°
6.9
26°
48°
70°
4.0
40°
5.6
45°
2.9
17.8
90°
comfort
range
30°
118°
127°
136°
3.0
75°
9.6
120-145°

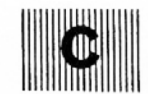
5.9
57.2"
1.1
3.5
53.7
2.0
7.0
1.5
47.1
45.6
9.1
23.4
8.1
30.0
6.2
4.5
2.6
16.2
2.8
0" datum
8.6

7.8
68.0"
1.5
4.2
63.8
2.6
8.4
2.5
55.8
53.6
11.0
28.3
9.8
35.7
7.5
6.6
3.1
19.2
2 to 3°
normal ℄ of
leg standing
30° stand
15° walk or
run
varies
3.2
10.3

bust ____ 30.0"
waist ____
hip ____ 33.0"

bust ____ 35.6"
waist ____ 29.2"
hip ____ 38.8"

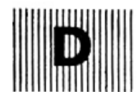
bust ____ 45.0"
waist ____
hip ____ 46.0"



ANTHROPOMETRIC DATA – MALE AND FEMALE CHILDREN

top figure in box is data for boys, lower figure is for girls, and one figure applies to both.

Age	Ht.	Wt.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	θ	Φ
17	68.2 63.6	138. 119.	12.2 11.5	20.7 19.7	16.3 15.1	15.6 14.4	3.4 3.	31.7 28.9	15.7 14.4	6. 5.8		13.2 12.1	12.9		3.7	12.3 11.5	10. 9.1	7.6 7.		35.3 33.5	31.3 29.5	17. 16.	7.3 7.6	5.2 5.	7.6 6.7		2.9 2.8	10.1 9.5	16"	27"
16	67.3 63.5	132. 118.	11.8 11.3	20.5 19.8	16.2 14.9	15.5 14.5	3.3 3.	31.5 28.9	15.2 14.3	6. 5.8		12.9 12.1	12.7 12.8		3.7	12.2 11.7	9.9 9.1	7.6 7.		34.5 33.4	30.5 29.4	17. 15.5	7.6 7.3	5.2 5.	7.4 6.9		2.8 2.7	9.8 9.4		
15	65.6 63.2	122. 115.	11.1	20.1 19.7	15.9 14.9	15.2 14.5	3.3 3.	31. 28.9	14.7 14.2	5.9 5.8		12.4 11.9	12.3 12.7		3.7	11.9 11.5	9.7 9.	7.5 7.		33.4 33.	29.4 29.	16. 15.5	7.5 7.3	5.1 5.	7.2 6.8	2.3	2.7	9.5 9.3	15	25
14	63. 62.3	109. 108.	10.9 11.	19.2 18.8	15.1 15.2	14.6 14.3	3.2 3.	29.7 28.5	14.1 14.	5.9 5.7	11.	11.6 11.4	11.6 12.3	5.6	3.6	11.4	9.3 9.	7.2 6.9	3.	32.1 32.4	28.1 28.4	16. 15.	7.4 7.3	5.1 5.	6.9 6.7	2.2 2.3	2.6	9.1		
13	60.5 60.6	96. 100.	10. 10.2	17.9 19.	15.5 14.3	13.9 14.1	3.2 3.	28.5 28.2	13.5 13.6	5.8 5.7		11. 11.1	11. 11.8		3.5	10.7 11.	8.8	6.8		30.9 31.5	26.9 27.5	15.5 15.	7.4 7.2	5.1 5.	6.6 6.5	2.2	2.5	8.9	14	24
12	58.2 59.	86. 90.	10.8 10.6	17.1 17.9	13.9 14.3	13.3 13.5	3.1	27.3 27.4	13.	5.8 5.7		10.6 10.7	10.6 11.2		3.4	10.3 10.6	8.4 8.5	6.6		29.9 30.3	25.9 26.3	14.5 14.7	7.3 7.2	5.1 4.9	6.4 6.3	2.2	2.5	8.6 8.5		
11	56.2 56.5	77. 79.	10.6 10.4	16.6 16.8	13.3 13.4	12.7 12.9	3.	26.1 26.3	12.6 12.4	5.8 5.7	10.5	10.2 10.3	10.1 10.5	5.	3.3	9.9 10.	8.1	6.3 6.4	2.8	29.2 29.1	25.2 25.1	14. 14.4	7.3 7.1	5. 4.9	6.2 6.	2.2	2.5 2.4	8.4	13	22
10	54.3 54.2	71. 70.	10.6 10.4	15.9	12.7	12.2 12.3	2.9	25.1 25.	12.3 12.	5.8 5.6		9.9	9.8 10.		3.2	9.5	7.8 7.7	6.1		28.5 28.2	24.5 24.2	14. 13.	7.3 7.1	5. 4.9	6. 5.7	2.2 2.1	2.5 2.4	8.3		
9	52.4 52.	64. 63.	10.7 10.3	15.1	12.2 12.1	11.6 11.7	2.8	23.9 23.8	11.8 11.5	5.7 5.6		9.5	9.1 9.5		3.1	9.1	7.4 7.3	5.9 5.8		27.7 27.4	23.7 23.4	13.5 13.	7.2 7.	5. 4.9	5.8 5.5	2.1	2.4 2.5	7.9 8.	12.5	20.5
8	50.4 50.	58. 57.	10.6 10.2	14.5 14.4	11.5	11.1	2.7	22.7	11.4 11.1	5.7 5.6	9.2	9.2	9. 9.1	4.4	3.	8.7	7.1 6.9	5.7 5.6	2.5	27. 26.6	23. 22.6	13. 12.5	7.2 7.	5. 4.9	5.7 5.4	2.1	2.4 2.5	7.7		
7	48.2 47.9	53. 51.	10.7 10.3	13.6	10.8 10.9	10.5	2.6	21.5 21.4	10.9 10.7	5.7 5.5		8.8	8.7 8.8		2.9	8.2	6.8 6.6	5.4 5.3		26.1 25.7	22.1 21.7	12. 11.5	7.1 6.9	5. 4.8	5.5 5.4	2.1	2.4	7.4	11	18.5
6	46.1 45.8	48. 46.	10.8 10.4	12.7	10.3	9.8 9.9	2.5	20.2	10.4 10.2	5.6 5.5	8.5	8.5	8.3 8.4	4.1	2.8	7.6	6.1 6.2	5.1	2.3	25.4 25.	21.4 21.	11.6 11.	7.1 6.8	4.9 4.8	5.5 5.3	2.	2.4	7.		
5	43.9 43.6	43. 42.	10. 9.7	12.7	9.6	9.2	2.4	18.9 18.8	10.1 9.8	5.6 5.4		8.2	8. 8.1		2.7	7.	6. 5.9	4.9 4.8		24.5 24.3	20.5 20.3	11. 10.	7. 6.8	4.9 4.8	5.4 5.2	2. 1.9	2.3 2.4	6.8 6.6	10	17.5
4	40.9	38. 37.	10.4 10.5	11.1 10.9	8.8	8.4 8.5	2.2	17.2	9.7 9.4	5.6 5.4		7.9	7.4 7.7		2.7	6.4	5.6 5.4	4.7 4.6		23.5 23.1	19.5 19.1	9.5 10.	6.9 6.7	4.9 4.8	52	1.9 1.8	2.3 2.2	6.6 6.5		
3	37.5																													
2.5	35.9 35.8																													
2	34. 33.7																													
1.5	31.8 31.5																													
1	29.5 28.8																													
.5	26. 25.5	6 MO.																												
	21.2 20.8	1 MO.																												
0	19.9 19.8	BIRTH																												



BASIC VISUAL DATA

easy head movement

max. head movement
note: avoid head movement if possible.

visual limit left eye

8.8" max. range
7.7" mean
7.1" min. range

monocular vision →

binocular vision →

visual limit right eye

LARGE HELMET SIZE 7 - 7.75 U.S.A. NEW DES.

60° 45° 15° 5° 5° 15° 45° 60°

94° 62° 35° 15° 15° 35° 62° 94°

limit of color discrimination
(varies with color & light intensity.)

limit of symbol recognition

limit of word recognition

30-60° 5-30° 5-10° 1° 0° 5-10° 5-30° 30-60°

std. line of sight

visual task area

opt. eye rotation

max. eye rotation

accurate seeing area

normal viewing angles

locate emergency controls within 30° color limit.

visual limit right eye

visual limit left eye

to prevent reflection on eye-glasses avoid light sources in these areas.

easy head movement

max. head movement.

50° 50° 30° 30°

4.6" 3.8 3.5

max. range

min. range

mean
1400 A.A.F. CADETS

5.8" 5.1 4.4

30° 40°

5.8 7.5

keep light sources above this line to prevent glare

upper limit of visual field

45° 50-55°

max. eye rotation

30° 25°

opt. viewing zone for displays

A B C D E F G H

4" 8.75" 13" 14-18" 20" 28" 40"

std. line of sight

0°

COMPRESSED SCALE

normal line of sight-standing

normal line of sight-sitting

10° 11° 15°

30° 35° 40°

opt. eye rotation

min. cut-off for vehicles

min. cut-off for cockpits

limit of color discrimination

lower limit of visual field

70-80° 30°

to prevent reflection on eye-glasses avoid light sources within these angles

6.6 6.1 5.5 2.8 2.5 2.2 5.7

5.5" 4.4" 3.5" 3.8 4.3 5.2 5.1 4.6 4.0

3.5 % men & 0.2 % women cannot be relied upon for signal detection.
54.0 % U.S. population over 6 years of age wear glasses.

A 4" min. focal distance – age 20.
B 8.75" min. focal distance – age 40.
C 13" min. acceptable reading distance for displays
D 14–18" normal viewing dist. - cathode ray tubes.
E 20" min. recommended distance for displays.
F 28" max. dist. std. displays based on reach.
G 40" min. focal distance – age 60.
H no dist. limit if display is designed to accord.

age 16 to 35 is best for color discrimination, > 66 is poor.



FOOT MEASUREMENTS AND BASIC FOOT CONTROLS

ACCELERATOR TYPE PEDAL

90-100° normal operating position.

97.5 %tile female foot is approx. equal in size to av. man.

average man shown for scale

DATA ACCOMODATES 95 % ADULTS

10"

A A A

alt. cue

1"

.5

3"±

1"

.25

B

Force = 10-15 lb.

1"-3"

heel support req. if B > 20°

floor

1" min. locating cue for blind reaching

3"±

pivot here provides treadle action for fine foot control.

PEDAL BAR FOR USE BY EITHER FOOT

14" min.

℄

℄ pedal and standing body

℄ foot

1" min. 3" opt.

4" 4"

8"-12" force > 30 lb.

4"-8" force < 30 lb.

toe-standing position.

PEDALS - ACCELERATOR

prefer this type over foot push buttons.

3" min. 4.25" opt.

9" min. 10"+ opt.

natural angle for right foot in relaxed position

10°

BRAKE TYPE PEDAL

90-100°

pedal travel

max. design range

.5" min. - normal

1." min. - boots

2.5" max. ankle only

7.0" max. leg

1.5"

parallel

2.5"

A

max. range

A

15°

av. man shown

30-55°

F

max. F

180-400 lb.

8" opt. 10" max.

3.25"

4"

1"

pedal force F:

4 lb. min. - no resting foot.

10 lb. min. - if foot rests

20 lb. max. ankle move. only

20-50 lb. leg movement

floor

PEDALS - BRAKE TYPE

4" min. 6" opt. — random operation - 1 foot

2" min. 4" opt. — sequential operation - 1 foot

pedal spacing

4.25"-4.75"

3" min.

4" max. dia. round pedal

min. pedal

opt. pedal

1" min. 3" opt.

FOOT PUSH BUTTONS

prefer ball of foot to heel operation.

provide snap feel.

use only if both hands are occupied, foot buttons are susceptible to accidental activation.

.5"- 2." dia.

FOOT PUSH BUTTONS

.5" min. displ.

1." min. - boots

2.5" max. - ankle

4." max. - leg

chair

floor

alt. location

prefer

F

4" min.

12" min.

4 lb. min. 20 lb. max.

10 lb. min. if foot rests.

RIGHT FOOT - AV. MAN

5.25" arctic boot

3.8" foot width

4.2" average male shoe

big toe lg.

10.5" foot lg.

℄

little toe lg.

11.75 av. shoe

14.3" max. design length arctic boot on 97.5 %tile

7.6" instep length

ball of foot

PLAN VIEW

3.0" ankle width

2.6"

heel width

	MEN			WOMEN		
percentiles →	2.5 %	50 %	97.5 %	2.5 %	50 %	97.5 %
foot length	9.6"	10.5	11.4	8.6	9.6	10.3
foot width	3.5"	3.8	4.2	3.1	3.6	4.0
instep length	6.9"	7.6	8.3			
heel width	2.3"	2.6	2.9			
ankle width	2.7"	3.0	3.3			



ANTHROPOMETRIC DATA — ADULT MALE STANDING AT CONTROL BOARD

78.7 - 60.6 range

50%tile

75.1 l.m.
70.2 av.
65.5 s.m.

3.5
3.3
3.1

70.5
65.8
61.2

1.2
normal
slump

60.1
55.7
51.4

2.1
2.0
1.8

48.1
44.6
41.1

1.6
1.2
.9

40.4
37.7
35.

22.4
20.9
19.3

4.9
4.6
4.1

1.1 heel

keep lights above
to minimize glare

visual limit

auxiliary panel for
unimportant displays

12

30°

13" min.
20 opt.
28 max.

top is invisible

72" max.

50°

10°

std. sight line

normal sight line

opt. viewing
range

30°

70°

7
A
displays only
or non critical
controls.
(stretching is not
recommended.)

65

10
B
optimum zone
for manual
and visual
combinations
(min. parallax.)

55

7
C
non critical or
casual controls,
manuals and
displays.

48

D
non critical
controls - avoid
if possible.
(stooping is
feasible.)

42

30°

45°

E

opt.
control
zone

12

B

alt.

30°

E

0-10° writing
shelf

finger tip reach
rad.: 30.7
28.5
26.5

10.4 max.

36

workbench std.
for vise work
and planing

18 max.

17.5 min. clear. for stool

E opt. bench ht.:
arm angles:

	30°	45°
97.5 % tile	53.	43.
50 % tile	49.3	40.
2.5 % tile	46.	37.4

use 30° for min. fatigue
and small work.
use 45° for dexterity
in assembly
and packaging.

4 - 6

6 min.

0" datum

38.5
36. min. gangways
34.

7 FT
6'-8"- 7'-0" std. door ht.
6'-8" min. ceiling ht.
6'-6" min. door ht.
6'-4" tel. booth door ht.

6 FT
6'-0" highest shelf

63" min. catwalk ceiling

5 FT
60 mirror ℄
58-60 thermostats and ℄ tel.
dial - men standing
54-60 grab bars - men

4 FT
48 wall switch
45 push bars
42-44 ℄ tel. dial - men sitting
42 bar ht., door pulls, lathe ℄
40-43 counter - men - std.
38 door knobs

3 FT
36-38 work bench
36-42 hand rails
34 hand rails - stairs
33 panic bars
31 lavatories
29.5 stool - 40.7 bench (l.m.)
28-29 table ht. - men
27.6 stool - 37.9 bench (av. m.)
26 min. knee clear.
25.7 stool - 35. bench (s.m.)

2 FT

17 av. compressed seat - men
15.75 max. ht. W.C.
15-16 max. step ht.

1 FT
12 opt. rung spacing

7-7.5 opt. stair riser
6-8 bar rail
4 min. toe space
1.1 av. heel - men



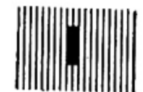
ANTHROPOMETRIC DATA — ADULT FEMALE STANDING AT CONTROL BOARD

73.1 - 57.2 range
50%tile
3.3
3.0
2.7
69.6 l.w.
64.8 av.
58.8 s.w.
65.4
60.9
55.3
-1.2
normal slump
57.4
53.3
48.7
2.2
1.9
1.5
3 max. allow. elbow rise
43.0
40.2
37.3
1.2
1.0
.8
37.3
34.7
31.6
20.8
19.4
17.8
4.8
4.6
3.4
1.6
0" datum

50° visual limit
keep lights above to minimize glare
unimportant displays
30°
15" min.
20 opt.
28 max.
68"
top is invisible
limit for emergency signals
30°
std. sight line
10°
30°
30°
normal sight line
opt. viewing range
70°
opt. control zone
15°
comfort range
12
B
60°
alt
0-10°
3" ea. woman
36 av.
36
oven door
writing shelf
18 max.
16 min. clear. for stool
reach R.
28.3
26.2
23.4
4-6
6 min.
34 min. gangway

A 8 — displays only or non critical controls. (stretching not desirable.)
60
B 9 — optimum zone for manual and visual combinations. (min. parallax.)
51
C 6 — non critical or casual controls, manuals and displays.
45
D 6 — non critical controls. (stooping is feasible.)
39

7 FT
6'-8" min. ceiling ht.
6'-8" - 7'-0" door ht. std.
6'-6" min. door ht.
6'-4" tel. booth door ht
6 FT
68" cannot see over ht.
64.5 highest shelf
63 min. cat walk ceiling
5 FT
58-60 thermostat ht. std.
58 mirror ℄
58 tel. dial ℄ - m. & w. standing
55 opt. tel. dial - women
50 push plates std.
48-54 grab bars - women
4 FT
48 wall switch std.
42 bar ht. std., door pulls
41 opt. tel dial - m. & w. sitting
39.5 opt. tel. dial - women sit.
39 max. counter ht.
38 door knob - std.
36 sink rim std., hand rails
3 FT
34 hand rails - stairs
33 panic bars
33.5-34.8 cleaning surfaces
32.3-34.3 food preparation
31.5-33.5 cooker hot plate
31 lavatories
30-32 ironing boards
27-28 table ht.
26.4 stool ht. - 36" counter
25-26 typing table
2 FT
24 min. knee clear - sitting
16 av. seat ht. - women
15.75 max. ht. W.C.
15-15.3 opt. seat ht. - public
1 FT
12 max. rung spacing
7-7.5 opt. stair riser
6-8 bar rail
4 min. toe space
1.6 av. heel - women



ANTHROPOMETRIC DATA — ADULT MALE SEATED IN VEHICLE

40" min. clear. at elbows (dynamic)
25 min. clear. at elbows (static)
23 min. clear. at shoulders
21" min. back rest
20" min. hip clear. 22" opt.
19.1 max. range
8 min.
min. side vision opt.
180°
220°
19 min.
16-18 std. wheel dia.
7 min., 21 max.
18 min. clear. at knees
24 opt. clear. at knees
sloping foot rest same angle as accel. normal pos.
14 opt.
80-90 lb max. p. clutch
2" min. spacing if sequential by same foot
2 min.
15 lb. max. p. brake
4.25-4.75 opt. x 3 ht.
3 W. x 1 min. ht. or 4" max. dia.
4.25 opt.
3. min.
10°

2" min. clear. for jolts
40.16" max. range - no slump
38.5 (97.5 %tile - no slump)
50 %tile
31.5 - no slump
27. (2.5 %tile with 2" slump)
42.0" min.
28" max. distance to std. displays
desired up vision
15°
15-30°
std. line of sight
15°
11°
35°
30° opt. eye move.
2.5 max.
15°
min. cut-off for cockpits
min. cut-off for vehicles
min. cut-off small man
or driver should see 10 ft. in front of vehicle
max. eye move.
opt. zone for manuals
comfort range
.75 min. 2. max.
90°
manuals
tractor back rest
3
3
max. ht. for shoulder movement
20°
15
min. thoracic support for relaxing
4.5
mid seat pos.
15°
18-20 opt., 22 max.
max. concavity
6R
9-10
15 min
29 min
min. lumbar support
4
3.5
sacrum support for rough terrain
3
0 datum
1.5 pad
97-105°
15° opt. range
25° max.
*105°
25.5 min.
30-60°
normal accel. operating position
max. press.
4 max. travel
4
10°
4
1.5 pad
6-8°
15.5 max.
6 min.
24.5 min.
17 max.
13 min.
90-100
15°
28° min. rest angle
8 opt. 10 max.
40-50°
12.25
4
5 max
10
9 min.

TOTAL SEAT ADJUSTMENTS:

horizontal: 6" min. in max. increments of 1"
vertical: 4" min. in max. increments of 1"

* leg angle 105-110° for max. pedal pressure 0-50 lb.
120° min. " " " " 50-100 lb.



HUMAN STRENGTH

(for short durations)

strength correction factors:
- X 0.9 left hand and arm
- X 0.84 hand-age 60
- X 0.5 arm & leg-age 60
- X 0.72 women

ARM FORCES SITTING

Ⓐ

14 LB. L. hand
19 LB. R. hand

back support

30°

52 50 R.
50 42 L.

15 18

17 R.
13 L.

56 42
42 30

20 18

POS. X

ARM FORCES SITTING

Ⓑ

8 L.
13 L.

8 15

20 R.
14 R.

20 15

POS. X

LEG FORCES SITTING

2.5" max. ankle travel

0-20 LB.

100-300

50-100

0-5

105-110°

120°

135-155°

ARM FORCES STANDING

floor lever

28 opt.

approx.
17 30 LB.

58"

40 50

18"

61 73

18"

40"

28"

max. force

0

hand forces >30-40 LB. are fatiguing

16" large force

LIFTING FORCES

close to body

24"

25 LB. max

30 — 5 FT.
45 — 4 FT.
70 — 3 FT.
125 — 2 FT.
145 LB. — 1 FT.

back lift is 40% leg lift.

max. hand squeeze: 85 LB. R.H.
77 LB. L.H.

BODY CLEARANCES

SUPINE

73" 75 opt.

20 24 opt.

PRONE

96" min.

17" min. 20 opt.

CRAWL

59" min.

31" min. 36 opt.

SQUAT

27" 36" opt.

48" min.

STOOP

26" 40" opt.

KNEEL

42" min. 36 opt.

56" min.

27"

MAINTENANCE REACH LEVELS

stand
kneel
sit

5 FT.
4 FT.
3 FT.
2 FT.
1 FT.

CLIMBING DATA

all data on this sheet accommodates 95% U.S.A. adult males

LADDERS

30" min

width:
15" min.
18 opt.
24 min. walls

provide back guard over 20'

7-16 (12 opt.)

.75-1.5 D. rung

90° 75°

opt. range

24

27

6 min.

STEP LADDERS

45" at 75°
62 at 50°

width:
21-24 with handrails
24 min. between side walls

X

3-6" tread

X=37"
75° X=34"
50°

range

7-10 riser

STAIRS

width:
24-30" 1 man
42 2 men

56" min.

8'-0" opt.
6'-8" min.

33"

.75-1.5 nosing

50°
35°
30°
17°

opt. range

7-7.25 opt.

9.5-11.0 opt. tread

RAMPS

width:
30" min.
42" opt.

7 FT. min.

1.75 D. max.

33.5"
36 at 0°

17°
10°
0°

opt. range

INGRESS & EGRESS

min. entries:
- 13-18" difficult — 1 man
- 18-24 fair — 1 man
- 24-36 good — 1 man
- > 36 good — 2 men

MIN. ESCAPE HATCH

pack

18 D. 24" opt.
18 sq.
or 19" W. x 16" L.

MIN. SIDE HATCH

20

pack

31" H.

MIN. BELLY HATCH

20"

29

pack

MIN. CATWALK

22 24" opt.

63" min
73 opt.

12 15" opt.

MIN. CRAWL THRU PIPE

25" D. 30" opt.

PASSAGE WAYS

42-48" min.
48-54 opt.

21-24" min.
30 opt.

13" min. clear. sideways



BASIC DISPLAY DATA

OPEN WINDOW DIALS

99 % accuracy in reading
use for exact data only.

2 nos. visible
.03" max. lubber line
alt. window location
alt. pointer
dials can overlap
manual control

RULE 1. numbers increase clockwise
RULE 2. associated control to move in same direction as dial.
RULE 3. move control clockwise to increase.
not recommended with manual control

CIRCULAR DIALS

89 % accuracy in reading
use for exact, relative or check data.

nos. increase clockwise
prefer nos. outside scale
zero here for + & - values
for left hand only
alt. for rt. hand
break scale
1" min. dia.
1-4" std.
1.75" for check
2.75-3." opt.
4-6" high accuracy
clockwise to increase reading.
opt. control pos.

SEMI-CIRCULAR DIALS

83 % accuracy in reading
use for exact, relative or check data.

use zones to simplify scale if possible
avoid moving dials.
same data as circular dials

avoid distracting trademarks on all dials.

nos. & spacing of scale markings ultimately determines dial sizes.

HORIZONTAL SCALES

72 % accuracy in reading
use for exact, relative or check data.
if scale moves use for exact data only.

increase left to right for pointer movement and scale numbers

for left hand only
alt. for rt. hand
opt. location of related control
prefer dial fix.
clockwise to increase

recommend manual & moving pointer

VERTICAL SCALES

64 % accuracy in reading
use for exact, relative or check data.
if scale moves use for exact data only.

increase bottom to top for pointer movement and scale numbers
prefer dial fix
opt. pointer on right.
alt. for rt. hand
long scales are possible by tape
min. opening to show 2 nos.
manual
clockwise to increase

recommend manual & moving pointer

COUNTERS

99 % accuracy in reading
use for exact data only.
rate: 2 nos. per sec. max.
read left to right.

nos. increase going up
equal
use blank here not zeros
drum spacing to be a min.
clockwise to increase

frame to be same color as drums
minimize frame shadows
least count nos. to snap into position

SCALES

numerical progressions

1 or x10   2   3 ◂good
5   100   10   15 ◂good
2   1000   4   6 ◂fair

use min marks
L
W
.005" min. index
.04 min. space
.5" min.
space > index

Average data:

	L (in.)	W (in.)
major index	.095 S	.015 S
intermediate index	.069 S	.013 S
minor index	.043 S	.011 S

S equals viewing distance in feet

POINTERS

index
.03 max. but > 0
tip width not smaller than minor index & not greater than the major index.
min. length tip to center
pointer color to match indices.
paint balance to match dial face

NUMERALS AND LETTERS

all nos. & letters to read vertically.
std. ht.
prefer titles on single line.
.25 panel title
.188 major
.125 middle
.094 minor
futura or U.S.A.F. std. cond. if req.
stroke ratio: 1 : 6 black on white
1 : 8 white on black
background contrast: 75-80 % +

Min. light = 1 ft.L.	min. (in.)	max. (in.)
critical markings	.043 S	.086 S
instructions	.021 S	.086 S
moving markers	.051 S	.086 S

S equals viewing distance in feet

MULTI-REVOLUTION DIALS

avoid multi-pointer dials
errors in reading are high
limit to 2 pointers

avoid this type as errors are high
zero here for 360° scale
opt. long scale indicator has counter for exact data.
use sub-dial for precision to expand a dial interval.

SIGNAL LIGHTS

label on top or within.
.25" dia. good if bright
min. space .75
or rect.
.5" dia. std.
1." master or emerg. signal

dark background increases eff.

flashing signals brightness 2 X .5" signal
1"
flash rate: 3-5 per sec.
on time: .05 sec. min.
off time > on

use green for satisfactory.
use red for unsatisfactory.
use amber for impending unsatisfactory.

DIAL ARRAY

order of sequence
opt. pointer position for check reading
consider green safe zones
2 nd. choice
min.
use std. sizes
prefer rows to columns.
consider unity & symmetry.

manuals to have relative positions



BASIC CONTROL DATA

BALL GRIPS

fingers .5 min.
hands 1.5 opt.
2. max.
10 lb. pull
20 lb. push
30 lb. max.
2-4" 1 hand
4-5" 2 hands
90° max.
lever
make L = max.
consider wrist support
2" min. displ. for L = 6"
14. max. fwd. & aft. displ.
38. max. laterally

CYLINDRICAL GRIPS

lever handles
1" min.
1.75 max.
3" min.
no max
avoid finger notching

grab bars and lifting handles
3.8 min. 4.5 opt
1.6 min. 2 finger
.375 min. 0-40 lb.
.875 min. 0-100 lb.
1.5" min.
2.0 opt.
also side clear.

FLUSH PULLS

for door, drawers etc.
1.25" min.
1.5 opt.
.4 R.
1.1 min.
1.5 opt.
.4 R.
.25
.4 R.
1.7 min.
1.9 opt.
15°
opening width: 3.5" min.
4.0 opt.

ROTARY KNOBS

use 1" for non critical settings.
& 2-4" for critical settings.
.25" min.
typ. serrations:
.08" dia.
.22 space.
.05 deep
.375" min.
.25 low force
4.0 max.
1 hand 1-2"
2 hands 3-5"
.5" min.
.875-1" opt.
.03 R.
5°
skirt
torque: 4.5 in.-oz. max. < 1" dia.
6.0 in.-oz. max. > 1" dia.

BAR KNOBS

15° min. - visual
30° min. - non visual
40° max. for opt. perform.
90° max. if req. mech.
displ.
.25 min.
1" min.
no max.
1" max.
.5" min.
3.0 max.
resistance: 12 oz. min. - 48 oz. max.
no. of positions: 24 max.
use round knob for rotation > 180°

GANGED KNOBS

sequential order
1 2 3
assoc. displays
.5" opt.
3" opt.
1.75 opt
serrate or knurl
5°
.75 opt.
.75 opt.
.25 min.

HIGH TORQUE KNOBS

for 5 finger grab
profiles for max. force:
< 90° rotate.
> 90° rotate.
avoid 3 5 and 6 prongs.
2" min.
4" max.
.37 min. R.
1" min. space.
finger flutes.
.5" to 1"
1" min. clear.
torque: 50 in. lb. max.

CRANKS

for rotations more than 90°
1.5" fingers
3.75 hand
R.
handle should rotate
taper avoids hand slip
.5 fingers
1.0 hand
.5" min. radius
20.0" max. - heavy load
4.5 max. - min. load, high speed
resistance: 5 lb. max. < 3.5" rad.
10 lb. max. 5"-8" rad.

HAND WHEELS

7" min.
21" max.
prefer min. no. spokes
down
up
.75 min.
2.0 max.
90° - 120° rotation to avoid shifting hands.
resistance:
5 lb. min.
30 lb. max. - 1 hand
50 lb. max. - 2 hands

PUSH BUTTONS

.625 min.
1 finger .75-1.25
2 fingers 1.25-2.0
.93 min. recess dia.
rect. for titles
.375 min. dia.
.5-1" opt.
1.5-2 palm
.5-2 foot
2" sp. rad. *
.25 lb. min. force
1-3 lb. opt.
31. lb. max.
4-20 lb. - foot
10-20 lb. if foot rests on it.
.05 R.
.125 min. - 1.0 max. defl. - no gloves
.25 - 2.0 gloves
.5 - 2.0 shoes
1.0 - 4.0 boots
* not required

PUSH BUTTONS – TOUCH SYSTEMS

prefer vertical buttons, fig. B
A
11° opt.
20° max.
B
4-11 oz.
.438 max.
.5" wide
.187 defl.
>0
.75
.312 min. clear.
operation rate: 4.1 - 5.3 per sec.

TOGGLE SWITCHES

prefer
ON
OFF ON
OFF
.125 min.
1.0 max.
.875 min.
4"-6" blind reach.
40° min.
60° opt.
120° max.
10 oz. min.
40 oz. max.
.5" min.
2.0 max.
1.5 min. - gloves
prefer bat shape
prefer 2 settings to 3 or 4



BASIC CONTROL DATA, PART 2

OPEN OR J HANDLE

3.75 min.
4" opt.
4.5" gloves
w
1" min.
2 opt.
2" gloves

w = .5" min. for over 40 lb
side clear: 2" ℄ to wall

T HANDLE

note: prefer 'J' or stirrup handles to avoid post

3" min.
4" opt.
4.5 gloves
break edges
1" min.
1.5 opt.
2" gloves
w
.188R
prefer min. of .5"

w = .125 up to 15 lb
w = .5" min. for over 40 lb
side clear: 2" to wall

RING PULLS

dia. in.	pull lbs.
1.0	40
.75	20-40
.5	15-20
.25	0-15

D

2.75 min. — hand
2.25 min. — 3 fingers
1.5 min. — 2 fingers
1.0 min. — 1 finger

AIRCRAFT HAND WHEEL

12-16"
6"
.125
curve to prevent catching of knees

FINGER RECESS PULL

finger tip .75 min., 1" gloves
full finger: 1.25 min., 1.5 gloves
lip
finger tip .5"
full finger 2"
finger tip: 5" min., .75 gloves
full finger: 2" min., 2" gloves

FINGER TIP RECESSED PULL

.5" R.
.5 min.
.625

length of recess 3.5 for 4 fingers

TRIGGERS

.25 min - .5 max.
break edges
.38R.
.56R
1"
guard
1"

PISTOL GRIP FOR TOOLS

consider shock mtg. if recoil

.2 travel
.37-.50
R
15°. 56R
1.62
.56
4.2 min.
.5R
10R
.94
2.75 min.
43R
1.87
.2 min
18°- 30

LEGEND SWITCHES

10 to 45 oz. resistance

.75 min
1.5 max
.1 min
.25 max. displ.
.75 min *
1.5 max.
flush if protected
R
.13 min.
.25 max.
barriers
.1 min.
.25 max. if gloves
* .56 if not recessed

THUMB WHEELS

dia. is 1.5 for 1 in.-lb.
2.5 for 3 in-lb.

.12 min.
.5 max.
1
2
3
alt. drum
.75 to 1" opt.
90°
D.
sharp serrations

note: avoid markings on wheel which are obscured by fingers

SLIDE SWITCHES

.2 min.
.5 max.
concave flat or convex
.5 min. R
.25 min.
.87 opt.
.25
serrations
minimum version
.2
.25 travel
.07
.06
sliding flags
.1

ROCKER SWITCHES

.75 min.
1.37 opt.
legend is possible
OFF ON
.37 min
.87 opt.
30°
.56 opt.

rockers can replace toggles
they give a visual cue of operation
serration on surface not required

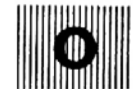


ACCESS OPENINGS

•INDICATES DESCRIPTION APPLIES TO DATA TABULATED BELOW

	HANDS			
	empty hand held flat	• bare 4x2.25"	• work gloves 6x3"	• arctic gloves 6.5 x 4"
	min. to wrist	3.5 sq.	5.5 sq.	6. sq.
	" " "	3.75 D	5.75 D	6.25 D
	clenched hand	3.5 x 5	4.5 x 6	7 x 8.5
	" " "	5. D	6. D	8.5 D
1"	inserting 1" object to wrist	3.75 D	6. D	7. D
	using pliers screw driver	5.2 x 4.5 4.2 x 4.6	—	—
L A B	one hand passing object	L = 4" A+B = 1.75	L = 6" A+B = 2.5	L = 6.5" A+B = 2.5
H .75 reach	two hands straight ahead reach = 6-25"	H = 4 add for vision	H = 6 add for vision	H = 6.5 add for vision
	ARMS			
	arm to elbow	—	• clothed 4.5" D	• arctic 7" D
	" " "	—	4.5 sq.	7. sq.
	arm to shoulder	—	5. D	8.5 D
	" " "	—	5. sq.	8.5 sq.
	FINGERS			
	one finger	• bare 1.25" D	• gloves 1.5" D	—
	recessed push button	0.93 D	—	—
	twist access eg. hold screw	2. D	2.5" D	—
	FOOT			
	access to pedal	bare 4.3x11.5	avg. shoe 4.7x12.7	arctic boot 6.3x15.3
	HEAD			
	head passage	bare 9.3"	military helmet 11.5"	work helmet 12.5"

	BODY			
	manhole	work clothes 22.8	—	space suit 36" D
	crawl thru pipe	• min. avg. clothes 25" I.D.	• prefer 30" I.D.	• arctic clothes 32" I.D.
	ceiling and floor hatch	18" D	22" D	32" D
	" "	18 sq.	22 sq.	32 sq.
	wall hatch	18 x 15	22 x 20	32 x 24
	side hatch incl. pack	20 x 32	—	—
	belly hatch incl. pack	20 x 29	—	—
	crawl thru	20 x 31	22 x 36	30 x 38
	prone access	22.8 x 17	30 x 20	30 x 24
H	catwalk	22" H = 63 12	24" H = 73 15	32" H = 75 15
	normal pass	22 x 76	30 x 80	30 x 80
	pass sideways	13 x 76	15 x 80	19 x 80
A	pressure hatch	20 x 44 A = 16" to floor	26 x 66 A = 10" to floor	—
	head bent	20 to 24 x 60	30 x 70	30 x 70
	head erect	20 to 24 x 70	30 x 80 to 84	30 x 80 to 84
	two men facing each other	30 x 76	36 x 80 to 84	36 x 80 to 84
	two men passing abreast	42 x 76	54 x 80 to 84	60 x 80 to 84



SEATING

1 CONVENTIONAL STRAIGHT CHAIR

FOR SHORT DURATIONS
USED FOR STUDY, WORK, & EATING

TOP OF BACK SERVES AS ARM REST
105°
FLAT SEAT PERMITS ROTATION
16"
ROLL EDGE
32-33"
SRP
0-5°
17" BEST AVG.*

SEAT WIDTH: 16-17"
* HIGH FOR SOME WOMEN (14-15" MAY BE REQ.) (OR USE FOOT STOOL)

2 WORK CHAIR

FOR LONG PERIODS
USED FOR STUDY, TYPING, & CONSOLES

NOTE: AVOID SPRING LOADED BACK RESTS
CENTER OF SUPPORT TO BE 1-2" ABOVE CENTER OF LUMBAR CURVE
BACK REF. PLANE
95-105°
SEAT REF. PLANE
5.1-8"
6-8"R
ADJ. 7-11"
12-15"
SRP
FINAL STABLE POSTURE
0-.75 COMP.
0-5°
ADJ. 15-18"

SEAT WIDTH: 15"
BACK REST WIDTH: 12-14"
BACK REST CONCAVITY: 16-18"

3 THREE POSTURE WORK CHAIR

FOR LONG PERIODS

1 2 3 ← BODY HUNCHED FORWARD
0-.5" COMP.
110-125°
115° OPT.
6"R
10-12"
0-.75" COMP.
9"
3"
32-33" SRP
5°
14-18"
5-7°
15-21" ADJ. OR = LEG LENGTH

SEAT WIDTH: 13.8-15.8"
ARM REST, INSIDE SPACING: 18" MIN.

4 EXECUTIVE AND CASUAL CHAIR

APPLIED TO THEATER CHAIRS IF FIXED & SEAT FOLDS

BACK REF. PLANE
.5 COMP.
FINAL STABLE POSTURE
105°
ARM REST AT TABLE HT. AIDS WRITING
12" MAX.
24" MAX. 17" MIN.
SEAT REF. PLANE
9" 0 TO 6"
OR HORIZ.
9"
1" COMP.
SRP
18" MAX.
3-5°
0° OPT. FOR WRITING
1" SOFT PAD, 1" FIRM PAD, WITH SHOCK ABSORBERS
17" EXEC. CHAIR
14" CASUAL CHAIR

SEAT WIDTH: 19" MIN.
ARM REST INSIDE SPACING: 19"
ARM REST WIDTH: 2"

5 HIGH CHAIR FOR STAND

ALSO USED FOR DRAFTING AND AT COUNTERS

SEAT DETAILS SIMILAR TO NO. 2
ADJ. 7-11"
SRP
18"
FOOT RING
18" DIA.
ADJ. TO 30"
12" MAX
NO CASTERS

PREFER FIXED FOOT REST ON CONSOLE

6 RAILROAD SEATING

ACCOMMODATES 90% ADULTS

BACK REF. PLANE
FINAL STABLE POSTURE
100-105°
FOR HEAD REST SEE SEAT NO. 10
28" MAX. TO AVOID HEADGEAR
PARALLEL TO SEAT OR FLOOR
SEAT REF. PLANE
THORACIC SOFT 8"
LUMBAR FIRM 4
SACRUM SOFT 3.5 3"
20"
8.5"
7°
SRP
3 3
5"
16.9"
ISCHAL TUBEROSITY SUPPORT, FIRM PAD
POPLITEAL SUPPORT, SOFT

SHOULDER WIDTH: 19" MIN. PER PERSON
HIP WIDTH: 19" MIN. PER PERSON
ARM REST WIDTH: 2"

7 AUTOMOBILE, TRUCK & TANK

INCLUDES LOW SILHOUETTE SEATING

42" PREFER
38.5 MIN. FOR 95% NO HAT
BACK REF. PLANE
97° ALERT POS. FOR DRIVER
105° REST POS. FOR RIDER
FINAL STABLE POSTURE
1.9" SLIDE UNDER CLEAR
14-15.1"
30-60°
20-24"
13-17"
8.7
10-17"
6-8°
6" MIN.
SRP
3"
5"
11-15"
28-40°
ISCHIAL TUBEROSITY SUPPORT
POPLITEAL SUPPORT

SEAT & BACK WIDTH: 18-21" (58 FOR 3)
VERT. SEAT ADJ. 5" HORIZ. SEAT ADJ. 6" TOTAL

8 TRACTOR SEAT

WITH LEG STABILITY

LUMBAR SUPPORT FOR RELAXING
SACRUM SUPPORTS FOR ROUGH TERRAIN
SIDE SUPPORTS
15-20°
18" MAX
1.2" PAD INSIDE
4.6
5
3
.5"
2.2" PAD
5"
45° OR 43-48
32"
SRP
60°
0-30
4-5"
ADJUSTMENT PLANE
ADJ 14-18"
1"
14.8
8"
30°
ADJ. 23-29"
12" MIN

SEAT WIDTH: 20.7" ARM REST: 2" WIDE
LUMBAR SUPPORT WIDTH: 10"

9 AIRCRAFT COCKPIT SEAT (MIL.)

ROOF
LINE OF SIGHT
101°
JOYSTICK OR WHEEL
1.5 1.5 ADJ.
9
6"
PARACHUTE 16" W
25
38" MIN FOR 90 %TILE
19"
STICK 25 WHEEL E
3.5
7
A
15
LIFERAFT
5
4°
C 3.5 ADJ.
SRP
B
5"

CHOOSE EYE LEVEL HT. A	A	B	C	D	E
	37	36	6.75	10°	27.0
	39	25	8.25	8°	28.5
	41	34.5	9.5	5°	30.5
	43	34.5	11.25	5°	32.0

10 AIRLINE SEAT

12°
26°
CHORD LINE
31" MIN. FOR HEAD SUPPORT
HEAD 11.5 11
13-15"
SEAT REF. PLANE
9"
7.25-9"
SRP
THORACIC 4
LUMBAR 3.6
SACRUM 3"
4"
SRP
17.5"
15.5"
48°
26°
22°ADJ.
ADJ. 28-33"
11.5"
34-36" MIN. PITCH
38-40" DELUXE

SEAT WIDTH: 21" MIN. > 1 HR. & 19" < 1 HR.

11 DENTAL CHAIR

A - SEAT PIVOT
B - BACK REST PIV.
C - LEG REST PIV.

DENTIST STANDS
14°
8°
DENTIST SITS
4.5"
11.5"
0-18" ADJ.
8.5" HORIZ.
B
8"R
8-9"
A
C
3R
FOOT PAD
22
12"
19"
10
15" HEAD LOW POS.
18 MAX
℄ ROTATION
2"

ARM REST: 2" W.
18" MAX.
MIN. TOE CLEAR
SEAT WIDTH: 20" TAPERS TO 12" AT HEAD END & 16.5" AT FOOT

12 SPACE COUCH

25 G MAX.

PROVIDE SEPARATE ARM POCKETS & ADJ. ARM RESTS
SAFETEY BELTS SHOULDER HARNESS & HEAD BANDS REQ.
2 BODY CONTOUR LATERAL SUPPORTS REQ. EACH SIDE
90°
FOAM FOOT REST
HEAD REST
PAD LINE
100°
117°
8°
HORIZ.
BACK PLANE
BACK PAN
SRP
SEAT PAN
LEG SEPARATOR IS REQ.
FINAL STABLE POSTURE

NOTE: PLASTIC CONTOURS TO BE DESIGNED TO PREVENT REBOUNDS
NOTE: SPACE COUCH TO BE CUSTOM MADE FOR EACH INDIVIDUAL



CONSOLES

1 OFFICE AND TYPIST DESK

2-3" (1-1.25" TYPIST)
18"
12 TYPIST
28"
25 TYPIST
17"
15.5"-19.5 TYPIST
ALT.
4"
22" MIN.
24"
18" TYPIST

2 WIDTH AND KNEE HOLE DATA
FRONT VIEW

28" MAX.
EFFICIENT WORKING W
24" OPT.
WORKING W
18" MIN
AT KNEE
NOTE:
OPEN SIDE WILL GIVE IMPROVED ACCESS
ALT.
FL.
24" MIN.
FOOT CLEAR.
OPERATOR SPACING 28" MIN.

3 SMALL CONSOLE, SIT DOWN

SEE OVER HT.
5-20°
A
50°
45" MEN
42" WOMEN
OPEN CONSTR.
28"
OPEN CONSOLE PROVIDES VENTILATION
REMOTE NOISY AND HOT EQUIPMENT
NOTE: IF STANCHIONS ARE USED PROVIDE 24" CLEAR. FOR OPERATOR

4 CRT CONSOLE SIT DOWN

CATHODE RAY TUBE
13"
ARM REST
60-80°
10" (13 IF 80°)
28-29"
17"
18"

5 CRT CONSOLE SIT OR STAND

12"
30° STAND
45° SIT OR STAND
14" MAX.
STAND ONLY
PROFILE IF STAND ONLY
18"
37-41"
28-32" STOOL
NO CASTERS
4" MIN.

6 STAND UP CONSOLES

DISPLAYS
CONTROL
0-30°
20°
SEE OVER HEIGHT
IF CONTROLS
IF WRITING
SLOPE ON TOP PREVENTS STORAGE
3
13 MIN.
16 MAX.
20°
0-5°
72" MEN
68 WOMEN
42" MEN
39 WOMEN
38" MEN
34 WOMEN
WALL
ALT.
SHELF MAY NOT BE REQUIRED

7 COMPOUND SIT DOWN

20°
17" SECONDARY DISPLAYS & CONTROLS
70" MAX.
FOR MEN
10°
19" DISPLAYS & CONTROLS
13"
16 MAX.
35°
5" CONTROLS
11" MAX.
8" MIN.
28 *
17"
* 29" HT IF CHAIR IS 18"

8 COMPOUND SIT OR STAND

10°
11"
NO CRITICAL CONTROLS
PRIMARY DISPLAY & CONTROL AREA
77" MAX.
FOR MEN
18"
10"
60°
12" MAX.
8 MIN.
66"
10°
42"
30"
10"
12"
NO CASTERS

9 CURVED PANEL SIT DOWN

A PUSH BUTTON & KEY BOARD
B KNOBS PUSH BUTTONS & TOGGLES
C DISPLAYS & KNOBS
D SECONDARY CONTROLS
E ARM REST
22R.
D
ALT. FLATS TO APPROX. CURVE
C
7"
B
E
A
15°
50"
7"
12
18
28"
17"

10 U SHAPE WRAP- AROUND
FOR INCREASED WORK SPACE

28" MIN.
44" MAX. TO REACH END PANELS
VERTICAL PANEL
SLOPING PANEL
13" MIN. WRITING SHELF
VERT. PANELS ABOVE SHELF LINE
PROJECTIONS IN FRONT OF SHELF IMPEDE ACCESS WITH MIN. PANEL
NOTE: CHAIR TO SWIVEL AND HAVE CASTERS

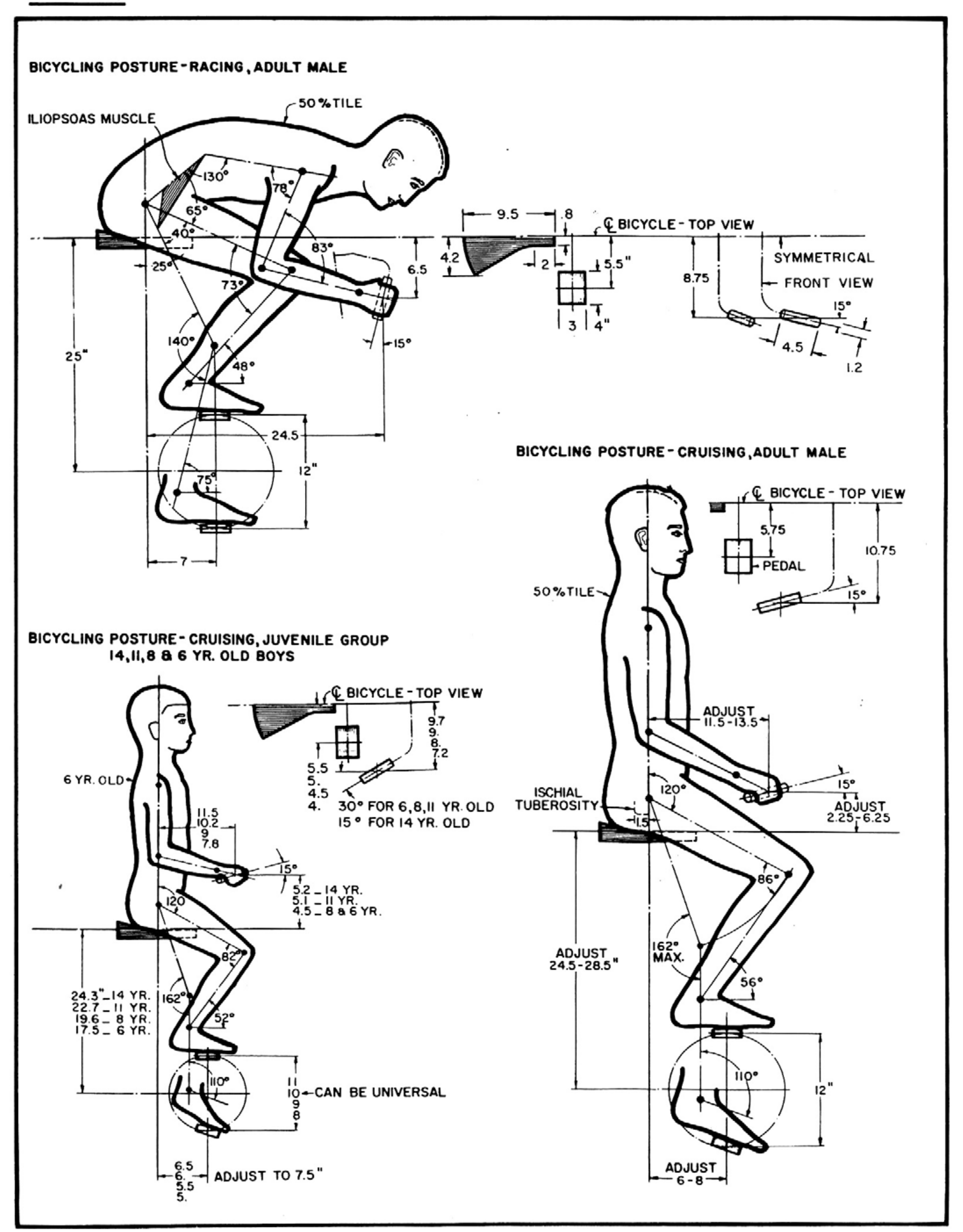
11 SPREAD U
IMPROVED VISIBILITY AND ACCESS

24" MIN.
40" MAX.
FOR I MAN
PREFERRED WORK LIMITS
60° IF 40"
45°
12"
16" SHELF
24"
135°
120° IF 40"
24"
VERTICAL PANELS
SLOPING PANELS
NOTE: CHAIR TO SWIVEL AND HAVE CASTERS

12 SEMI-CIRCULAR
CAN HAVE HEMISPHERICAL PANELS

VERTICAL PANELS
SLOPING PANELS
SHELF VARIES
13-15"
8.5"
28R
7"
INFREQUENT USE AREAS
24" MIN.
INFREQUENT USE AREAS
NOTE: CHAIR TO SWIVEL AND HAVE CASTERS

BICYCLES


BICYCLING POSTURE - RACING, ADULT MALE
50%TILE
ILIOPSOAS MUSCLE
130°
78°
65°
40°
25°
83°
73°
140°
48°
15°
6.5
25"
24.5
75°
12"
7
9.5
.8
4.2
2
5.5"
3
4"
℄ BICYCLE - TOP VIEW
SYMMETRICAL
FRONT VIEW
8.75
15°
4.5
1.2
BICYCLING POSTURE - CRUISING, ADULT MALE
℄ BICYCLE - TOP VIEW
5.75
PEDAL
10.75
15°
50%TILE
ADJUST 11.5-13.5
ISCHIAL TUBEROSITY
120°
1.5
15°
ADJUST 2.25-6.25
86°
ADJUST 24.5-28.5"
162° MAX.
56°
110°
12"
ADJUST 6-8
BICYCLING POSTURE - CRUISING, JUVENILE GROUP 14, 11, 8 & 6 YR. OLD BOYS
℄ BICYCLE - TOP VIEW
9.7
9.
8.
7.2
5.5
5.
4.5
4.
30° FOR 6, 8, 11 YR. OLD
15° FOR 14 YR. OLD
6 YR. OLD
11.5
10.2
9
7.8
15°
5.2 _ 14 YR.
5.1 _ 11 YR.
4.5 _ 8 & 6 YR.
120
82°
24.3" _ 14 YR.
22.7 _ 11 YR.
19.6 _ 8 YR.
17.5 _ 6 YR.
162°
52°
110°
11
10 ← CAN BE UNIVERSAL
9
8
6.5
6.
5.5
5.
ADJUST TO 7.5"



ENVIRONMENTAL TOLERANCE ZONES

ENVIRONMENTAL COMFORT ZONE

Factor	Comfort zone	Tolerance limit
CARBON DIOXIDE (parts per million parts of air)	1700 ppm / 0 ppm	40,000 ppm
OXYGEN	60% / 15%	> 60% / < ?
VENTILATION	20 cu ft/min / 13 cu ft/min	> 50 cu ft/min / < 5 cu ft/min
HUMIDITY	70% / 30%	> 90% / < 10%
TEMPERATURE (degree Fahrenheit)	upper limit 75° F / 65° F lower limit	> 100° F / < 30° F
HEAT LOSS (British thermal units per hour)	1450 active / 330 rest	> 3000 Btu/hr
ATMOS. PRESSURE (pounds per square inch atmosphere)	20 psia / 10 psia	> ? / 8 psia
ACCELERATION (one gravity is 32.2 feet per sec. per sec.)	0.1 g / 0 g	> 1 g
ELECTRICITY 60 CYCLE (milliamperes)	1 ma / 0 ma	10 ma
ATOMIC RAD. (roentgen equivalent man per year)	0.2 rem/yr / 0 rem/yr	15 rem/yr
ULTRA VIOLET RAD.	unknown / 0	unknown
LIGHT (foot candles) avoid glare	100 fc / 20 fc	10,000 fc
NOISE (decibels) avoid continued silence	85 db / 0 db	> 94 db
MECH. VIBRATION (cycles per second) (inches amplitude)	0-1 cps / 0-.005 in.	10 cps / 0.05 in.
SHOCK WAVES (pounds per square inch-gage)	2.5 psig / 0 psig	> 7 psig
CARBON MONOXIDE (parts per million parts of air)	100 ppm / 0 ppm	3000 ppm

Humidity ↕ Temperature: interrelated

THE BAND BETWEEN THE CIRCLES INDICATES THE ZONE FROM COMFORT TO THE TOLERANCE LIMIT. OUTSIDE THIS LIMIT GREAT DISCOMFORT OR PHYSIOLOGICAL HARM IS ENCOUNTERED. OTHER FACTORS NOT SHOWN AND TO BE CONSIDERED ARE: INFRA-RED RADIATION, ULTRA-SONIC VIBRATIONS, NOXIOUS GASES, DUST, POLLEN, CHEMICALS & FUNGI.



THREE BASIC HUMAN BODY TYPES

EXTREME VARIATIONS OF THE AVERAGE MAN IN THE U.S.A.
MOST MEN FALL SOMEWHERE IN BETWEEN THESE TYPES.
ALL VALUES ARE TYPICAL RANGE MEASUREMENTS.

STATURE: 69.1" AVERAGE MAN

6.8"
3.8"
5.9"
2.6"
5.5"
2.0"
6.3"
3.2"
2.8
4.7"
3.0"
2.5"

8.8"
13.0"
A
A
5.3
4.5"
5.0"
4.1
5.9"

6.1"
17.1"
ADD 1" + FOR SITTING
B
B
13.0"
HIP PIVOT
10.0"
4.0"

CLOTHING THICKNESS: A = 0.25" LIGHT, 0.75" HEAVY
B = 0.5" LIGHT, 1.0" MEDIUM, 1.25" HEAVY

ECTOMORPH

MESOMORPH

ENDOMORPH

THREE BASIC HUMAN BODY TYPES

EXTREME VARIATIONS OF THE AVERAGE MAN IN THE U.S.A.
MOST MEN FALL SOMEWHERE IN BETWEEN THESE TYPES.
ALL VALUES ARE TYPICAL RANGE MEASUREMENTS.

80" STATURE LARGE MAN (RANGE)

ABT. 11"

STATURE: 69.1" AVG. MAN

ABT. 11"

58" STATURE SMALL MAN (RANGE)

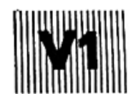
5.3"
14.5"
8.0"
7.9"
8.3"
11.4" SITTING
3.2"

7.0"
22.8"
A
15.4"

16.0"
A
19.3"
21.3" SITTING
5.1"

CLOTHING THICKNESS: A = 0.15" LIGHT AND 0.75" HEAVY

ECTOMORPH MESOMORPH ENDOMORPH



COMPARISON OF THE 2.5 PERCENTILE U.S. ADULT MALE IN SUMMER ATTIRE AND THE 97.5 PERCENTILE IN HEAVY WINTER CLOTHES.

A DESIGN WHICH INCLUDES THESE 2 MEN WILL ACCOMMODATE 95 PERCENT UNDER MOST CLIMATIC CONDITIONS.

dimensions include all types of Army gear, heavy winter flying clothes (A.F.), and civilian work and street clothes.
pressure suits and heated suits are not included.
data on arctic clothing is uncompressed.

2.5 PERCENTILE

65.4" to floor
61.1" eye level
16.5 shoulder width
51.7
6.3
6.3
6.6
10.3
10.9 chest
6.6
26.5"
9.4
3.2
6.4
grip line
6.8
2.8
15°
3.2
15.7
1"
12.3 hip width
13.2 sitting
15.2
3.0
0"
4.0 shoe
1.0 heel ht.

arm span 65.5"
arm akimbo span 34.9"
total weight 131.7 lb.

97.5 PERCENTILE

77.4" to floor – no slump
1.2" normal slump
fedora
2
3" arctic
70.8" eye level
10.5 safety hat
9.0 helmet
11.0 arctic parka hood
21.3" shoulder width
60.3
26" arctic
7.6
7.6
12.0
8.0
13.4 chest width
31.4"
8.0
10.5
3.7
7.4
8.9
9.5 arctic
3.2
8.2
18.0
4.3
5.5 arctic
7
1.7
2.3 arctic
23" arctic sitting
16.2 hip width
17.8 sitting
5.9 knee width
17.5
3.8
0"
5.4 boot
1.3 heel ht.

arm span 78.1"
arm akimbo span 43.2"
total weight 132. lb.



COMPARISON OF 2.5 PERCENTILE U.S. ADULT MALE IN SUMMER ATTIRE AND THE 97.5 PERCENTILE IN HEAVY WINTER CLOTHES

16.5 shoulder width
16.5 elbow width
13.2 seat width
15°

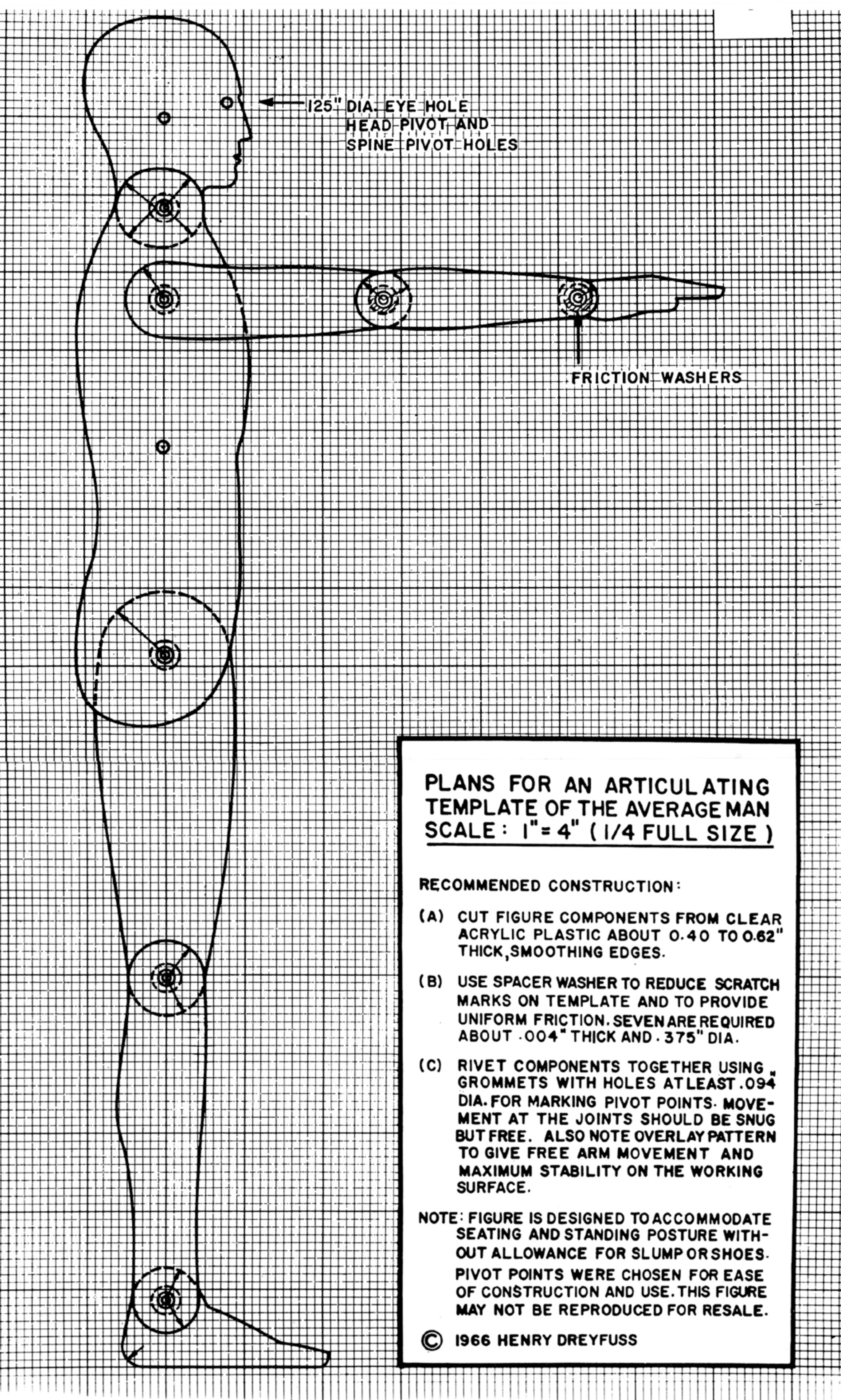
26.0" arctic, uncompressed
21.6" elbow width, 27.5 arctic
21.3 shoulder width, 26.0 arctic
17.8 hip width, 23.0 arctic
15°

3" arctic parka hood
40.5" head to seat - no slump
2
2" normal slump
12.0 safety hat
11.0 helmet
4.5
34.3" eye to seat
15°
normal sight line
7.6
2.6
26.4
2.1
23.8
12.2 chest depth
15.5 arctic, uncompressed
12.0
16.6
21.8
8.5
1.8
10.5
5" civ.
6 mil.
1.6
13.2
7.8
9.8
18.0
4.2
0.4
6.1
20.5
17.5
6.4
27.2"
26.5
27.5 arctic
25.4
19.4
3.8
1.25 heel
11.4
14.3 boot

3.1
33.6" head to seat
29.3" eye to seat
15°
normal sight line
7.0
21.4
19.4
2
8.1 chest depth
10.3
13.1
17.3
6.8
1.1
3.7
9.4
.9
8.2
15.7
3
5.2
4.2
0.2
17.6
15.2
22.0
21.0
16.3
3
1.0 heel
9.6
10.8 shoe

2.5 PERCENTILE IN SUMMER ATTIRE

97.5 PERCENTILE IN WINTER CLOTHES


.125" DIA. EYE HOLE
HEAD PIVOT AND
SPINE PIVOT HOLES
FRICTION WASHERS
PLANS FOR AN ARTICULATING TEMPLATE OF THE AVERAGE MAN
SCALE: 1" = 4" (1/4 FULL SIZE)
RECOMMENDED CONSTRUCTION:
(A) CUT FIGURE COMPONENTS FROM CLEAR ACRYLIC PLASTIC ABOUT 0.40 TO 0.62" THICK, SMOOTHING EDGES.
(B) USE SPACER WASHER TO REDUCE SCRATCH MARKS ON TEMPLATE AND TO PROVIDE UNIFORM FRICTION. SEVEN ARE REQUIRED ABOUT .004" THICK AND .375" DIA.
(C) RIVET COMPONENTS TOGETHER USING GROMMETS WITH HOLES AT LEAST .094" DIA. FOR MARKING PIVOT POINTS. MOVEMENT AT THE JOINTS SHOULD BE SNUG BUT FREE. ALSO NOTE OVERLAY PATTERN TO GIVE FREE ARM MOVEMENT AND MAXIMUM STABILITY ON THE WORKING SURFACE.
NOTE: FIGURE IS DESIGNED TO ACCOMMODATE SEATING AND STANDING POSTURE WITHOUT ALLOWANCE FOR SLUMP OR SHOES.
PIVOT POINTS WERE CHOSEN FOR EASE OF CONSTRUCTION AND USE. THIS FIGURE MAY NOT BE REPRODUCED FOR RESALE.
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